Research and Economic Development Committee Agenda
May 11, 2022
1:00 – 3:00 pm
Gateway Center, Salon C

1. Joint meeting of Research and Economic Development (RED) Subcommittee Meeting with Academic and Student Affairs Committee (30 min)
   a. RED Subcommittee members:
      i. Dave Fall, Chair
      ii. Brad Bonner
      iii. Elizabeth Greenwood
      iv. Brad LaCroix
   b. Academic and Student Affairs Subcommittee members:
      i. Michelle Sullivan (Chair)
      ii. Brad Bonner
      iii. Macey Moore
      iv. Laura Schmid-Pizzato
   c. RED Subcommittee Presentation – Wyoming Innovation Partnership (WIP)
      i. Steve Farkas, Assoc Vice President for Economic Development
      ii. Bryan Shader, Special Assistant to the President, Professor of Mathematics
      iii. Dan McCoy, Degree Coordinator & Associate Lecturer, Outdoor Recreation and Tourism Management
      iv. Penelope Shihab, Director, Center for Entrepreneurship and Innovation

2. RED Meeting
   a. Science Initiative Wyoming Research Scholars Program – Jamie Crair, Program Director and student presentations (30 min)
      The Wyoming Research Scholars Program is a university-wide UW Science Initiative program that pairs undergraduate students with faculty mentors to participate in cutting-edge research starting as early as their freshman year.
   b. Wyoming IDeA Networks for Biomedical Research Excellence (INBRE) Student Programs – Annie Bergman, Director and student presentations (30 min)
      Each Fall, Spring, and Summer semester, the Wyoming INBRE program funds about 10 UW undergraduates wishing to engage in biomedical research. INBRE also funds competitive awards for outstanding community college life science students who are transferring to the University of Wyoming to pursue careers in the biomedical sciences. The program will provide financial support for selected students to attend UW for up to 2 years and engage in INBRE-supported research activities in addition to their degree coursework.

3. Science Initiative Update – Greg Brown, SI Executive Operations Director, Mark Lyford, SI Programs Director and Diana Hulme (15 minutes)

4. Electronic Research Administration System Update – Farrell Rapp, Research Services Director (5 minutes)

5. Other business (5 minutes)

6. Adjourn
Dr. Dan McCoy

- Began at UW in 1999
- Ran the UW Outdoor Program for 19 years
- 2017, helped develop and coordinate the Outdoor Recreation and Tourism Management Degree
- Director, WORTH Initiative (since March)
Why the WORTH Initiative? Supporting our #2 Economic Driver in 2021

- **8.1M** Visitors
  - 16.8% Increase

- **$4B** Direct Spending
  - 31.2% Increase

- **$243M** Tax Revenue
  - 50.5% Increase

**Travel GDP**
- **$1.6B**

**State GDP**
- **$41.9B**

Sources: Dean Runyan Associates, Bureau of Economic Analysis
Largest employment sector in Wyoming

Average=35,021

SOURCE: BUREAU OF LABOR STATISTICS
n-Employment is not disclosed.
Leisure & Hospitality employment contains jobs also supported by residents, but can be used as an indicator of the travel industry.
Recovery & resilience

2020

<table>
<thead>
<tr>
<th>Visitors</th>
<th>Direct Spending</th>
<th>Tax Revenue</th>
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<tbody>
<tr>
<td>6.9M</td>
<td>$3.1B</td>
<td>$159.8M</td>
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25.6% Decrease          22.9% Decrease          21.4% Decrease

Source: Dean Runyan Associates, The Economic Impact of Travel Report, April 2021. Click here for the report.

2021

<table>
<thead>
<tr>
<th>Visitors</th>
<th>Direct Spending</th>
<th>Tax Revenue</th>
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<tbody>
<tr>
<td>8.1M</td>
<td>$4B</td>
<td>$243M</td>
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16.8% Increase          31.2% Increase          50.3% Increase

Source: Dean Runyan Associates, The Economic Impact of Travel Report (Preliminary), February 2022. These preliminary estimates for Wyoming are subject to revision as more complete source data becomes available.
Vision

- An expanded, diversified and more resilient Wyoming economy
- WORTH industries thriving and growing
- Leaders and innovators nationally in applied research, professional development, and outreach
The WORTH Initiative

**PROFESSIONAL DEVELOPMENT**
- BS in Hospitality Management
- Certificates & continuing ed.
- On-line/distance learning
- Student experiences

**OUTREACH & EXTENSION**
- Extension agents
- Assistance for state
- Economic analyses

**APPLIED RESEARCH**
- Surveys, intercept studies
- Data-informed decisions
- Graduate student research
- Student internships
UW Students and WORTH

Capstone projects for Outdoor Recreation and Tourism Management degree

New BS in Hospitality Management

Emergent research support (research assistants)

Educational products (trainings and certifications)

Internships
Framework

ORTM EDUCATION
- Real-world Interdisciplinary Experiences & Entrepreneurship Training
- Expanded Distance Learning, Certificates & Non-degree Training

ORTM Graduates
- Industry Professionals

IMPROVED & EXPANDED OR&T Workforce

SUPPORT & OUTREACH
- OR&T Extension Specialists Support for OR&T Businesses
- PARTNERSHIPS: Wyoming Office of Tourism, Government Small Business Programs
- SERVICES: Development, Planning, Marketing, Investment, & Planning

EXPANDED & DIVERSIFIED OR&T Businesses

APPLIED RESEARCH
- Faculty Engagement with OR&T Businesses
- Applied Research & Consulting
- Dissemination of Findings

INNOVATION OR&T Businesses

ECONOMIC IMPACT: EXPANDED OR&T INDUSTRY
Questions?
Science Initiative Undergraduate Research Programs

University of Wyoming Board of Trustees
Research & Economic Development Committee
May 11, 2022
WYOMING RESEARCH SCHOLARS PROGRAM

Pairs undergraduate students with faculty mentors to conduct their own, cutting-edge research.
Protection of Biologics Using Sugars and Intrinsically Disordered Proteins

Maxwell Packebush
Boothby Laboratory
University of Wyoming
Anhydrobiotic Organisms and Protection of Biologics

- Tardigrades are an anhydrobiotic extremotolerant microorganism
- Tardigrades use sugar substrates and intrinsically disordered proteins (IDPs) to protect themselves
- Sugars and IDPs can be used to prevent aggregation and preserve protein function

A) B. Goldstein & V. Madden B) S. Stammers C) W. Gabriel
What are Blood Clotting Factors

- Proteins made in the liver that inhibit blood loss by coagulating liquid blood at the site of injury
- The clotting factor cascade is important for regulation of blood clotting
Instability of Blood Clotting Factors

- Clotting Factors must be stored at -20°C
- Storage of clotting factors at 4°C for 21 days results in 50% degradation
- Clotting ability decreases by 15% in just 10 hrs at room temperature
Can Substrates/Peptides Protect Blood Clotting Factors from Degradation?

• Sugar substrates and peptides such as Sucrose/ Trehalose and Intrinsically IDPs have been observed to protect client proteins in under desiccation and heat stresses

• Can these sugar substrates and IDPs be used to protect clotting factors/ biologics under stressful conditions without impeding proper clotting function?
Trehalose Protects FVIII at Multiple Temperatures

FVIII + Trehalose at 95C

FVIII + Trehalose at 60C

Title

0ng/mL Trehalose
10mg/mL Trehalose
2.5mg/mL Trehalose
20mg/mL Trehalose
Def (+)
Def (-)
Next Steps

• Test IDPs as a protectant for FVIII under heating and desiccation stresses
  • Optimize concentrations of protectants

• Use IDPs as a protectant for other blood clotting factors

• Use IDPs and sugar substrates as a protectant for other biologics
Stratigraphic relationships surrounding the Cretaceous-Paleogene (K-Pg) Boundary within the northern Great Plains, USA

By: Gracen Wallen
Introduction

- K-Pg boundary was deposited globally, approximately 66 million years ago
- Distinct layer of clay
- Associated with mass extinction event and large positive iridium anomaly
- Abrupt end to the age of the dinosaurs

(Bercovici and Fastovsky, 2015)
Research Question

How do stratigraphic relationships vary surrounding the Cretaceous-Paleogene (K-Pg) boundary within surface exposures across the northern Great Plains of the United States?
Methods

1. Identify late Cretaceous and early Paleogene exposures across the northern Great Plains of the United States.

2. Measure and describe stratigraphic sections containing the K-Pg boundary from each exposures across Wyoming and Montana. These sections will include the K-Pg boundary and a minimum of five meters of underlying and overlying sediments.

3. Collect samples of the K-Pg boundary and every distinct layer of sediment measured, where permitted.

4. Create stratigraphic column based on each section measured.
Study Area

• Extensive surface exposures across the states of Wyoming and Montana.

• Two stratigraphic sections measured and described in Garfield County, MT.

(Fowler)
Stratigraphic relationships surrounding the K-Pg boundary in Garfield County, MT. Study Site #1.
Fort Union Formation

K-Pg

Hell Creek Formation
Findings

• K-Pg boundary believed to be preserved in both locations within the “z” coal layer

• For both sites:
  • Uppermost section of Hell Creek Formation consists of interbedded sandstones and siltstones, with intermittent layers of coal
  • Abundance of flora and fauna found within Hell Creek Formation, little to none found in the overlying Tullock member of the Fort Union Formation

• Variations in thickness and composition of stratigraphic layers between the two study sites

• More extensive lignite exposures in study site #1 compared to study site #2
Future Directions

• Create thin sections of sediments collected and then examine them under a microscope, notating any observable variations

• Analyze samples of K-Pg boundary for an iridium anomaly and examine variations in iridium concentration between the different study sites
Acknowledgements

• Dr. John Kaszuba, Department of Geology and Geophysics, University of Wyoming.
• Department of Geology and Geophysics, University of Wyoming.
• The Wyoming Research Scholars Program, University of Wyoming.
• McNair Scholars Program, University of Wyoming.
• Dr. Mark Clementz, Department of Geology and Geophysics, University of Wyoming.
• Professor Carl Campbell, Saint Louis Community College.
• Susannah Wright, University of Wyoming.
• Matthew Mers, Emporia State University.
References


Understanding the role of iron in nutritional immunity during *Toxoplasma gondii* infection

Gigley Immunology Lab

Sai Kit Ng

Spring 2022
Three P’s of *Toxoplasma gondii* (T. gondii, “Toxo”)

1. **Prevalence**
   - Tropism: Nucleated animal cells
   - 2 billion + humans are infected (~1 in 3)

2. **Persistence**
   - No curative therapy exists
   - Infections are lifelong

3. **Prognosis**
   - 4th highest cause of foodborne hospitalizations in US
   - Can be lethal when Toxoplasmic encephalitis develops

Tenter et al., 2000, *Int J Parasitol*
Immune Cell Delegation in *T. gondii* infection

**Cytotoxic T Cells**
- Th1
- Th2
- Th17
- Treg

**Helper T Cells**
- Th1
- Th2
- Th17
- Treg

**Iron**

**Encystation**

**Chronicity**

Gigley, Fox, and Bzik 2009
Gazzineli and Sher 1994
Denkers, Gazzineli, and Sher 1993
2. Does iron homeostasis impact T cell response to *T. gondii?*

**Experimental Setup**

*HFE-*
C57BL/6 Background
Jax # 017784
Null Allele

Mice Groups (N=3)

- a. Naïve, No Treatment (*Normal Iron Condition*)
- b. ME49, No Treatment (*Normal Iron Condition*)
- c. ME49, 10mg/mL DFP (*Reduced Iron Condition*)
- d. HFE, No Treatment (*Elevated Iron Condition*)
- e. HFE, 10mg/mL DFP (*Rescued Iron Condition*)

**Readout**

- a. T Cell Function

**Flow Cytometry**

10 DPI

Splenic single cell suspension (SpSCS)

10 mg/mL DFP treatments at t=-1 day, then subsequent treatments every other day
2. Does iron homeostasis impact T cell response to *T. gondii*?
2. Does iron homeostasis impact T cell response to *T. gondii*?
Do changes in iron homeostasis affect *T. gondii* pathogenesis?

Survival and Survival Weights (avg.)
Future Directions

• What role does iron homeostasis play on intrinsic T-cell biology?
• What role does iron homeostasis play on the myeloid and NK cell population during infection?
• What is the role of iron in nutritional immunity in long-term memory populations?
Acknowledgements

The Gigley Lab
Principal Investigator
Dr. Jason Gigley, PhD

Graduate Students
Stephen Denton
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Undergraduates
Kaatje Fisk
Hunter Keplinger
Leah Bernstein
Lindsay Nevarez
Alexa Meija
Mackenzie Long
McKenna Hackett
Anja Sheesley
Assessing a Potential Intersection Between Glymphatic Clearance and Circadian Rhythms

Hannah W. Rhymes, Dr. William "Trey" Todd
Department of Zoology & Physiology

Research & Economic Development Committee
University of Wyoming
May 11th, 2022
Circadian Rhythms

- Patterns of physiological and behavioral activity aligning with 24hr light/dark cycle
- SCN (located in hypothalamus) uses light input from the eyes to synchronize internal rhythms with external stimuli

Glymphatic Clearance

- Brain lacks lymph vessels to clear waste
- Cerebrospinal fluid flows through spaces around vessels to flush out waste products
- Relies on AQP4 water channel proteins to exit this space and wash through the tissue
Circadian Rhythms
Maintains steady sleep cycle, but can be disrupted by external stimuli
Circadian disruption occurs very early on in AD, and is prevalent in patients with mature AD
Evidence that strength of circadian rhythmicity grows weaker with age

Glymphatic Clearance
Circadian pattern of AQP4 expression; primarily active during sleep
Responsible for clearing amyloid-Beta proteins, a pathology hallmark for AD, from interstitial space
Capacity for CSF flux and solute clearance reduced dramatically with age

OVERLAP
Interactions with sleep/wake cycle
Strong association with Alzheimer's Disease (AD)
Aging is a risk factor for diminished function

Strong association with Alzheimer's Disease (AD)
Evidence that strength of circadian rhythmicity grows weaker with age
Aging is a risk factor for diminished function
Healthy mice and mice with AD pathology will differ in their expression of AQP4 channels and astrocytes in brain regions associated with circadian rhythm regulation.
Mutant group = Transgenic mice w/ AD pathology

All subjects tested for signs of circadian disruption
- "Young" = tested at 3-5 months
- "Old" = tested at 7-9 months

Suprachiasmatic Nucleus
- Main location of interest

Fluorescent staining (IHC)

Objective: acquire preliminary data, assess the potential of this research direction
Results:
Astrocyte staining

- No readily identifiable differences
Results:

AQP4 staining

- Reduced variability in both young groups
- High variability in both old groups
- Highest expression of AQP4 found in majority of old group mutants
Circadian Disruption

- Older mutants exhibit later peaks of body temperature (Tb) and locomotor activity (LMA)
- Taking longer to enter resting phase = indicator of circadian disruption
- Not seen in younger mutants
Discussion, Relevance, and Next Steps

**Astrocytic expression in SCN**
- No observable differences for now

**AQP4 expression in SCN**
- Increased expression of AQP4 in hypothalamic regions for older mutants
  - Aligns with results from prior studies that focused on cortical regions
- If AD pathology affecting the SCN, then AQP4 may be "working harder" (increased expression) to clear waste

**Continuing work**
- Assess differences in AQP4 and astrocytic expression in relation to AD markers
  - Tau and Amyloid-Beta
- Investigate cell overlap between AQP4 and astrocytic expression for more specific insight
- Assess expression in two other regions:
  - **Subparaventricular zone (SPZ)**, which is known to receive inputs from the SCN
  - **Lateral parabrachial nucleus (LPB)**, which is known to project outputs to the SCN
• The Wyoming Research Scholars Program has been quite successful, and we aim to continue growing it to the original goal of ~100 students/year

• We recently adopted a method to reach even more students, particularly in their freshman year
  – **Course-based Undergraduate Research Experiences (CUREs)**

• Many institutions have some form of CURE - notable ones include UT Austin, U Maryland, SUNY Binghamton, etc.
Course-based Undergraduate Research Experiences (CUREs)

- Accommodate many more students than traditional research internships
- Help reach underrepresented students
- Example: University of Texas-Austin Freshman Research Initiative (FRI)
  - 3-course CURE has involved thousands of students since 2005 (~900/yr)
  - CUREs are most effective over multiple semesters early in a student’s education

Students who complete UT CURE show significant improvements in (A) probability of graduating in STEM major and (B) graduating in 6 years. (Rodenbusch et al. 2016)
Recent CURE Implementation at the University of Wyoming

CURE Program Curriculum

**Freshman Year**
- **Fall**: CURE Semester 1
  - LIFE 1101: FYS- Intro to Research
- **Spring**: CURE Semester 2
  - LIFE 2200: Research in Action

**Sophomore Year**
- **Summer**: Summer WY Research Scholars Fellowship Program
- **Fall**: CURE Semester 3
  - LIFE 2300: Scientific Communication
- **Spring**: Peer Mentoring & Independent Research

Adapted from University of Maryland FIRE Program
LIFE 1101: Introduction to Ecological Research

Began developing CURE sequence in 2019

Fall 2019: “Beaver pond ecosystems”
Taught as a Special Topics course (½ semester, 4 hrs/week)

Fall 2020: “Freshwater ecology”
Under First-Year Seminar (FYS) designation
Worked in the nearby Laramie River and remote locations

Fall 2021: “Beaver pond ecosystems”
Under First-Year Seminar (FYS) designation
Happy Jack area of Medicine Bow National Forest
Background and Significance
Beavers are known ecological engineers that construct dams and affect the flow of water. This in turn changes the surrounding ecosystem. With the data we gathered we can use it to look at a multitude of ecosystem advantages

- Use of the water for agricultural irrigation
  - Allows for irrigation later in the season
- Increase in vegetation
  - Plants preferred pH is more acidic (pH<7)
- Density of aquatic life
  - Fish preferred pH is more neutral (pH=7)

Methods and Equipment
- Data was collected using the following equipment on three separate occasions
  - YSI Pro Plus – used to obtain field levels of dissolved oxygen, pH, temperature and atmospheric pressure.
  - Ion Chromatography – used in the lab to obtain concentration levels of cations and anions in mg/mL

Results Explained
- The temperature of the pond compared to upstream and downstream was significantly different (p<0.001, Figure A)
- On days, the water was tested, there was always a significant pH difference between the upstream and downstream water (p<0.01, Figure B)
- Ion levels in all samples were insignificantly different

Conclusion
- We can conclude with this data, that there is a relation between the water quality of the pond compared to the free-flowing up-stream and down-stream water

Other 2019 teams studied:
- Bird Diversity
- Willow Disease

Location and Time
- Pole Mountain of the Medicine Bow National Forest outside of Laramie, WY
- September 18, September 25 and October 2 from 2-4pm

Hypothesis
- We hypothesize that the water quality of the beaver dam will differ from that of the free flowing water due to the stationary water around the dam

Other 2019 teams studied:
- Bird Diversity
- Willow Disease

References
Introduction

- Wildlife diversity can be impacted by human presence, and it can be difficult to learn more about those effects.
- Camera traps have become the most efficient way of monitoring animal populations.
- Using these traps, our team was able to watch riparian zones without affecting the variable of human activity.

Objective & Hypothesis

- To determine whether human foot traffic has an effect on wildlife diversity and abundance.
- We hypothesised that wildlife diversity and abundance will decrease when human activity is increased.

Methods

- We collected data at three separate locations along the Laramie River in Wyoming.
- The sites varied in human foot traffic levels with low, medium, and high foot traffic.
- Camera traps were placed at the medium (n=3), high (n=3), and low (n=4) foot traffic sites.
- We checked cameras one to two times per week, changed out the SD cards, and recorded which animals were caught by the camera trap.

Results

- In terms of diversity level, the high area had an $H$ value of 1.89, the medium area had 1.68, and the low area had 1.71 (Figure 1).
- The level of human foot traffic did not significantly affect wildlife diversity.
- The calculated richness value was 9 in the high activity area, 7 in the medium activity areas, and 7 in the low activity area (Figure 1).

Discussion

- Human activity appears to only affect types of animals spotted in the area.
- A larger number of individual animals were spotted closer to the high human activity area (Figure 1).
- Further research should focus on a limited number of species when determining diversity to get more accurate data.

Other 2020 teams studied:

- Cattle Grazing
- Macroinvertebrates, Algae, and Velocity
- Water Quality and Macroinvertebrate Richness

**Figure 1. The number of each individual animal from species grouping spotted on camera traps at different sites.**

- Mink (*Neovison vison*)
- Rabbit (*Oryctolagus cuniculus*)
- Raccoon (*Procyon lotor*)
- Fox (*Vulpes vulpes*)
- Other
The Effect of Beaver Ponds on Water Quality Using the EPT Index
Conducted by [Students]

Introduction
• Unlike other herbivores, beavers greatly impact ecosystems with a range that exceeds their presence.
• Water quality can be determined through the EPT index.
• EPT (Ephemeroptera, Plecoptera, Tricoptera) are intolerable to pollutants, making them crucial indicators in water quality.
• Equation used to determine EPT index:
  \[
  \frac{\text{Total EPT Taxa}}{\text{Total Taxa Found}} \times 100.
  \]

Question and Hypothesis
Will beaver ponds affect the EPT index, and ultimately the water quality?
We hypothesized that the EPT index would be higher in beaver ponds than that of upstream.

Methods
• Using a YSI probe, we measured the dissolved oxygen (mg/L), pH, and temperature (°C)
• Using an Oakton PCTSTestr 50 probe, we measured the salinity (ppt.)
• Obtained samples using a D-Net.
• Calculated EPT index

Discussion and Conclusion
• Unlike previous studies, there was no significant difference in the total EPT proportion among sites and ponds (Fig. 2) suggesting our sample size was too small.
• The difference between EPT proportion and sites was insignificant (p > 0.05) but there was a visually noticeable difference between the pond sites (dam, mouth) and the stream site.
• There was no significant difference in total number of insects, and taxa richness among sites (Fig. 1).
• There was a significant difference in the total number of insects and taxa richness among ponds (Fig. 1) suggesting that collecting samples from more ponds may strengthen results.

Other 2021 teams studied:
• Mammal Diversity
• Water Flow and Aquatic Insect Diversity
• Soil Nutrients

References
### Assessment – Fall 2020 FYS CURE survey

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<tr>
<th>Level of experience with</th>
<th>Average student estimate (±SD)</th>
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<tbody>
<tr>
<td>Projects where only the instructor knows outcome</td>
<td>Some (3.2 ± 1.0)</td>
</tr>
<tr>
<td>Projects where no one knows the outcome</td>
<td>Some (2.6 ± 0.6) <strong>to</strong> Much (4.2 ± 0.7) (p &lt; 0.001)</td>
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<tr>
<td>Projects entirely of student design</td>
<td>Some (2.9 ± 1.1) <strong>to</strong> Extensive (4.6 ± 0.5) (p &lt; 0.001)</td>
</tr>
<tr>
<td>Reading primary scientific literature</td>
<td>Some (3.1 ± 1.0) <strong>to</strong> Much (4.4 ± 0.9) (p = 0.020)</td>
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<tr>
<td>Writing a research proposal</td>
<td>Little (2.4 ± 1.0) <strong>to</strong> Extensive (4.6 ± 0.5) (p &lt; 0.001)</td>
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### Science attitude statement

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<th>Likert scale response (±SD)</th>
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<tr>
<td>Even if I forget the facts, I'll still be able to use the thinking skills I learn in science</td>
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<tr>
<td>I can do well in science courses</td>
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- Estimates of experience: None = 1 (1.0-1.5); Little = 2 (1.6-2.5); Some = 3 (2.6-3.5); Much = 4 (3.6-4.5); Extensive = 5 (4.6-5)
- Rows in **bold** indicate significant changes in reported experience level pre vs. post (adjusted p-values < 0.05; paired t-test)
- For rows in which no significant change was detected, reported means and SD represent average values of pre and post survey results (from North and Crait 2021)
Course-based Undergraduate Research Experiences (CUREs)

CURE Program Curriculum

Freshman Year

- Fall: CURE Semester 1 LIFE 1101: FYS- Intro to Research
- Spring: CURE Semester 2 LIFE 2200: Research in Action

Sophomore Year

- Summer: Summer WY Research Scholars Fellowship Program
- Fall: CURE Semester 3 LIFE 2300: Scientific Communication
- Spring: Peer Mentoring & Independent Research

Adapted from University of Maryland FIRE Program
Course-based Undergraduate Research Experiences (CUREs)

- Proposed Plan moving forward
  - Develop multiple research-based FYS courses across STEM disciplines, culminating with students and faculty designing a small research project

CURE FYS

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<th>Field Biology</th>
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<tr>
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<td>Physics</td>
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<td>MOLB</td>
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<td>Etc.</td>
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Course-based Undergraduate Research Experiences (CUREs)

- Proposed Plan moving forward
  - Second semester Quantitative Reasoning (Q) course with lab sections. Students analyze data in Q course (LIFE 2200 may be good model or match for lecture side)
  - Add section of COM2 – Scientific Communication

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<th>CURE FYS</th>
<th>CURE Q</th>
<th>CURE COM2</th>
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<td>Analysis</td>
<td>Communication</td>
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<td>Lab Biology</td>
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Course-based Undergraduate Research Experiences (CUREs)

- Proposed Plan moving forward
  - Students completing sequence could receive Certificate (perhaps with other requirements like K-12 Outreach, presentation at UG Research Day) & would be well positioned to move into mentored research
CUREs Looking Forward

Challenges
• Curriculum integration
• Resources & logistics

Opportunities
• Recognized value
• Model for new courses
• Unique research opportunities in WY
  • UW-NPS Research Station
• Freshman CURE bootcamps
Questions?
WY INBRE
Student Programs

Annie Bergman, Ph.D.
Director, INBRE Student Programs
Director, UW STEAM Camps
UW INBRE Internships

• Academic Year internships: (~10 hours/wk in lab)
• Fall/Spring 2021 (10) – 160 hours
• Fall only option - 80 hours
• Spring only (10)– 80 hours

• Summer Internship – 10 weeks; full-time $6000
  culminating in INBRE Summer Research Symposium
  • 2021 (17)    2022 (17)
Transition Student Program

WY Community Colleges provide experience in:

• INBRE Research Labs
• INBRE Research Course
• UW-INBRE Collaborative Grants
Transition Student Awards

• Students apply in spring of their second year
• Accepted students receive funding at UW for their junior and senior years $5000/yr
• Two lab rotations followed by ‘home lab’ selection
  Independent, mentored research
RAIN: Regional Alliance of INBRE Networks

- Summer Internships: applications from our 7 western INBRE states
  - 2021: Dipesh Pokharel (pre-med in the Bobadilla Lab)
- Research awards in regional INBRE labs in ID, MT, NM, NV, AK, HI
  - National labs, INBRE labs, Data Science virtual and in-person workshops
B Eyond the ‘Bench’ support

• Becoming a Resilient Scientist training
  • Resilience/Wellness skills and resources

• Professional Development skills – writing/presentations/etiquette

• Community service opportunities
  • STEAM outreach and inreach with K12 during the school year
  • UW STEAM Camps – outdoor, place-based for elementary & MS youth
  • WSSF judging and Enrichment Day
  • Afterschool STEAM/Youth Tennis

• Women in Math, Science & Engineering events

• Women in STEM events: Own It! and MS/HS student activities
Skylar Hodgins - Dr. Ana Clara Bobadilla
Brett Ralston – Dr. Amy Navratil
Caleb Price – Dr. Mark Gomelsky
Taylor Hatcher – Dr. Michael Dillon
Gareth Flowers – Dr. John Oakey
Structural Plasticity of Dendritic Spines Within Cocaine-Seeking Neuronal Ensembles

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INTRODUCTION

- Substance Use Disorder (SUD)
  - Uncontrollable use of drugs resulting in life impairment
- AUD problem: relapse 40 – 60%
- Brain Region of Interest: Nucleus Accumbens (NAC)
  - Center of motivation, learning, and reward pathways
  - Coactivated brain cells = neuronal ensembles

Mouse Model
- Human and mouse brains process cocaine similarly
- Transgenic mice allow for specific tagging of cocaine-seeking ensembles
- Green fluorescent protein (GFP) used to tag non-seeking ensembles

Synaptic Potentiation
- Increased coactivation during seeking strengthens pathway and action potential for negatively reinforced behavior

Nucleus

POTENTIATION

Dendritic Spines

Neuronal Ensemble

Medium Spiny Neuron

Spine Synaptic Potentiation and Depression

Fig. 2: Dendrite spine synaptic potentiation and depression.

METHODS

- 10 Days (24 hours/day)
- 5 Days Treatment
- Tagging of Cocaine-Seeking Ensembles
- Immunofluorescence
- Brain Collection

ICAM-1

Fig. 5: Self-Administration (SA) Timeline

IMARIS VS. SPINEJ

- IMARIS resulted in significantly different spine morphology.
- SpineJ is suited for 2D analysis of shorter dendritic segments.
- IMARIS will be the primary software for spine analysis in future Bobadilla Lab research.

CONCLUSIONS

- COCAINE-SEEKING SPINE PLASTICITY
  - Optimize GFP tagging of animals not actively seeking cocaine.
  - Characterize spine remodeling in polysubstance models of SUD.

REFERENCES


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Bioengineering of Light Controlled Proteins

PRESENTER:
Caleb Price

BACKGROUND: cAMP is the most important signal relay in the body, responsible for all the processes below.

A special construct is needed to achieve this control using a bacteriophytochrome (part that gets turned on by light) and an adenylate cyclase (makes cAMP).

METHODS
1. Mutate the L5BO-mSc plasmid to make changes that might improve construct
2. Put the L5BO-mSc plasmid into E. Coli cells.
3. Grow cells in light and in dark.
4. Sort cells based on fluorescence
5. Verify ideal cells

RESULTS

Your Body Can Be Controlled with Light

Caleb Price, Oliver Trunschke, Mark Gomelsky

UNIVERSITY OF WYOMING

Wyoming INBRE

WYOMING NASA SPACE GRANT consortium
Shal expression did not change with time or differ between control and cold-exposed bees for either species.
Laminated Plastic Microfluidic Systems for Continuous Nanoparticle Precipitation and Rapid Immunoassays

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Abstract:
Microfluidic devices have become widely used across research disciplines. The most common fabrication method for microfluidic devices is replica molding in poly(dimethylsiloxane) (PDMS). This is quick and convenient for laboratory researchers and has enabled applications in diverse fields, such as lab-on-a-chip systems, cell encapsulation, and protein precipitation. However, PDMS-based devices are not scalable, and are often limited by their inability to withstand certain solvents, such as ethanol, acetone, and acetonitrile. Here, two new manufacturing methods are explored for the sake of particle precipitation and lateral flow immunoassay microfluidic devices. Particle precipitation is a technique used for the formation of polymeric nanoparticles used as drug delivery systems. Lateral flow immunoassays can be used to perform rapid and accurate detection of viral infections such as COVID-19. By using polyethylene terephthalate (PET) layered with a 3M adhesive or thermal laminating sheets, assembled layer-by-layer, new microfluidic devices can be developed providing robust, scalable, and modular systems. Thermal lamination provides an even more robust system and more facile device production, by the elimination of the adhesive needed to bond the PET layers. While the PET system can withstand acetonitrile, the adhesive dissolves slightly in the solvent, making this method suitable for particle precipitation, because both of these methods employ layer-by-layer assembly, they introduce the ability of modularity. Fabrication is not possible in PDMS. By rearranging, adding or subtracting layers upon a standard manifold footprint, a wide variety of devices with different applications could be created in a “Lego-like” fashion.

Methods and Materials:
- Laser Cutter:
  - Epilog Fusion Pro Laser Cutter
  - 3M PET Transparency Film (PP2500)
  - 3M 467MP Double-Sided Adhesive
  - In-house 3D printed manifold
- Vinyl Cutter:
  - Silhouette Cameo 4 Vinyl Cutter
  - Scotch Thermal Laminator
  - 3M Thermal Laminating Pouch 3mil
  - 3M 467MP Double-Sided Adhesive
  - In-house 3D printed manifold

Conclusion:
- Fabrication Streamlined
- Swelling Less of an Issue
- More Uniform Flow Profile
- More Photogenic
- Imperfections Still Present

Future Work:
- Characterization of Swelling
- Exploration of Different Adhesives
- Create Uniform Flow Profile
- Decrease Imperfections Further

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Purpose:
- Mitigate Solvent Dissolution
- Streamline Fabrication
- Increase Resolution
- Decrease Imperfections

Figure 1: Laser cut Nanoprecipitation device mixing area.

Figure 2: Laminar vs. Turbulent mixing.

Figure 3: Close of mixing area in laser cut Nanoprecipitation device.

Figure 4: Laminated Nanoprecipitation device.

Figure 5: PET Lateral flow immunoassay prototype.

Figure 6: Later rendition of PET lateral flow device.

Figure 7: Imperfection (lip) produced by fabrication processes.

Figure 8: Assembled Nano precipitation device.

Figure 9: PET lateral flow immunoassay prototype.

Credit:
Researchgate.com

Figure 10: IMSF Nano precipitation device.

Figure 11: Assembled Nanoprecipitation device.
Thank you!

- WY INBRE
- UW Office of Research & Development
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- NASA Space Grant Consortium/Science Kitchen
- Our network of UW and Community College faculty and students!